

FIG. 1

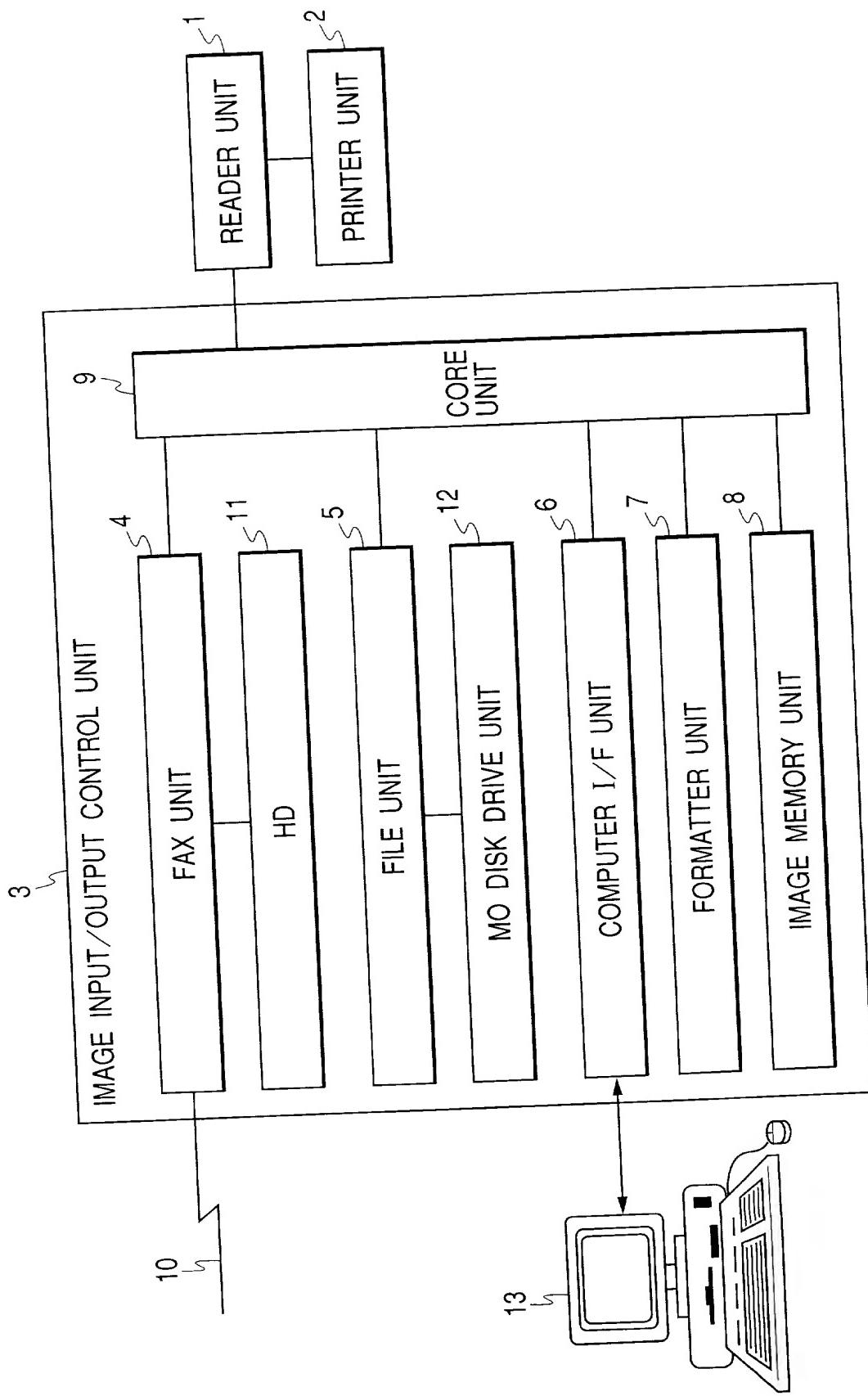


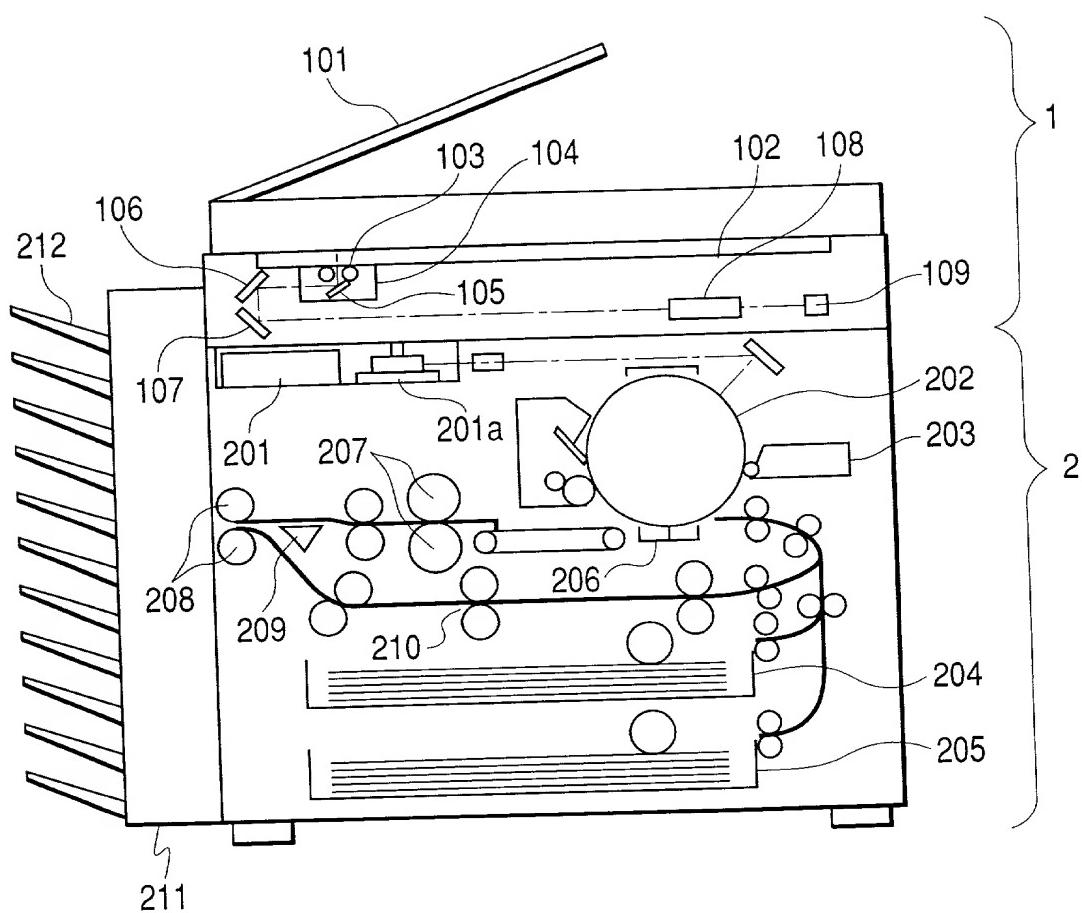
FIG. 2

FIG. 3

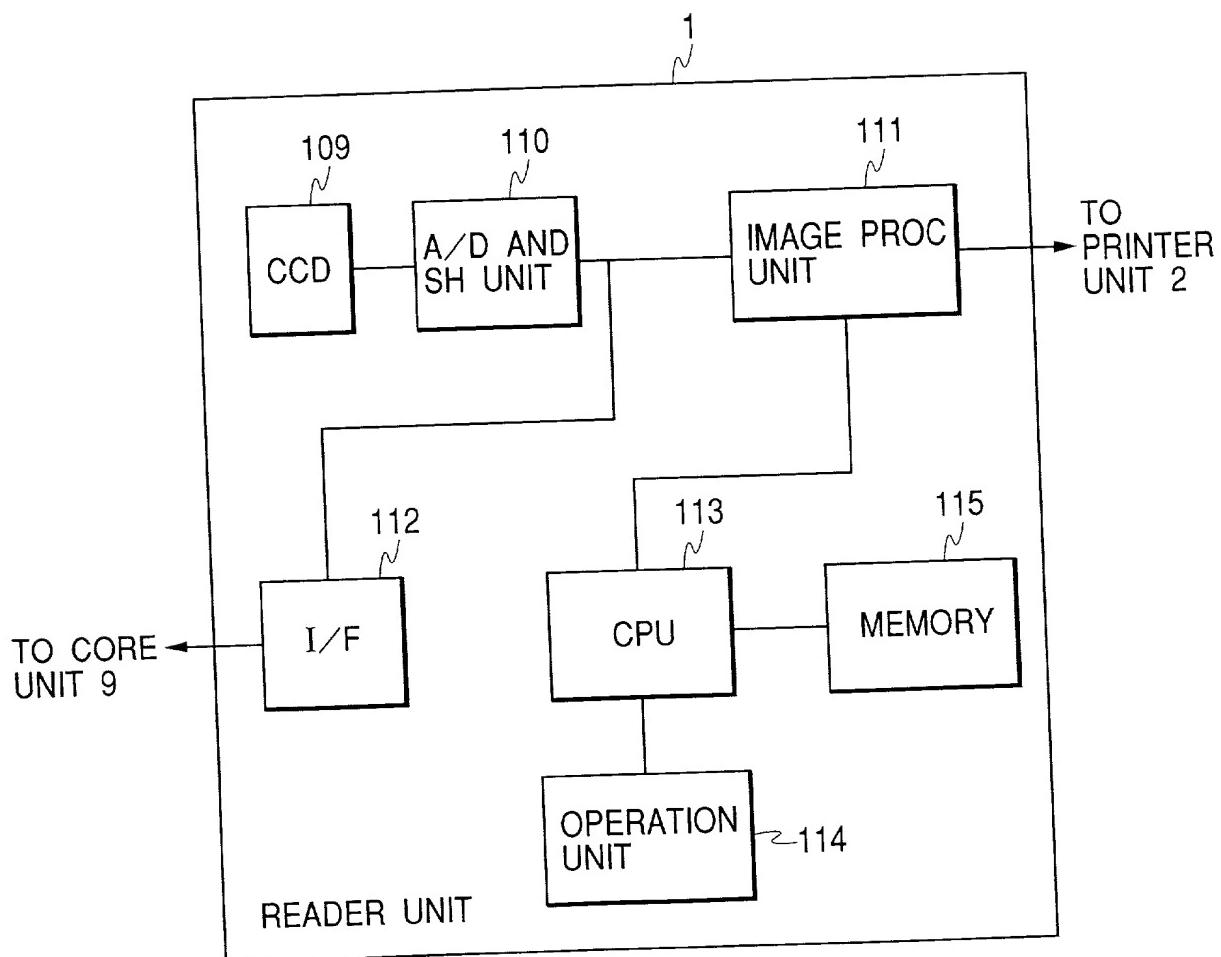


FIG. 4

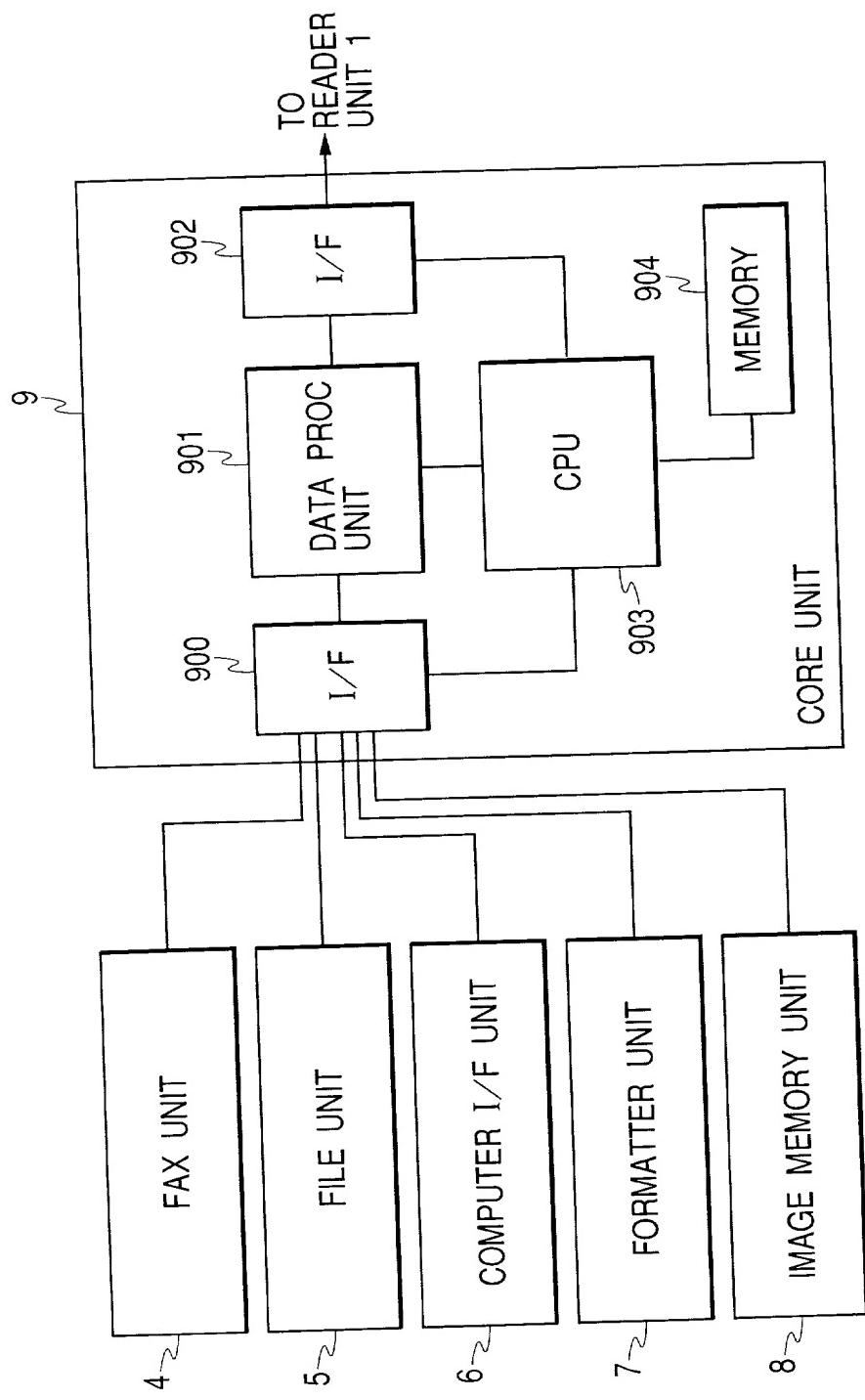


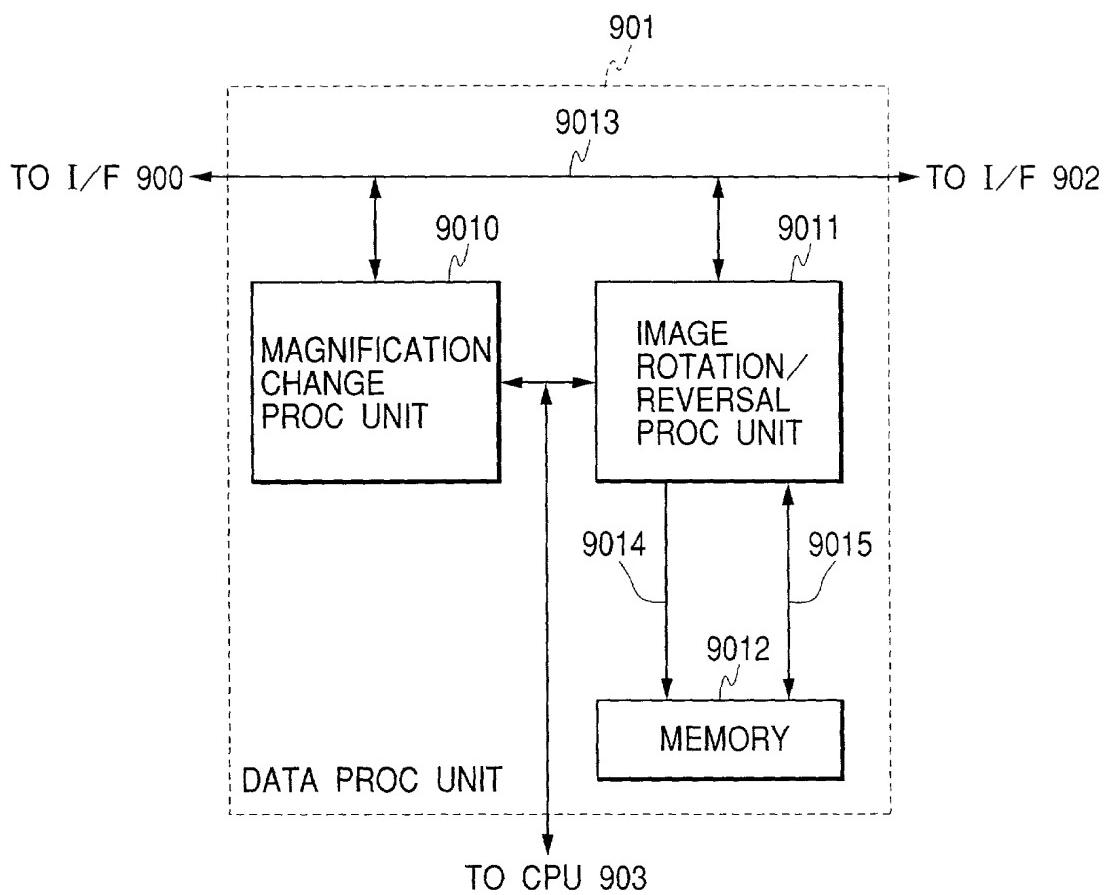
FIG. 5

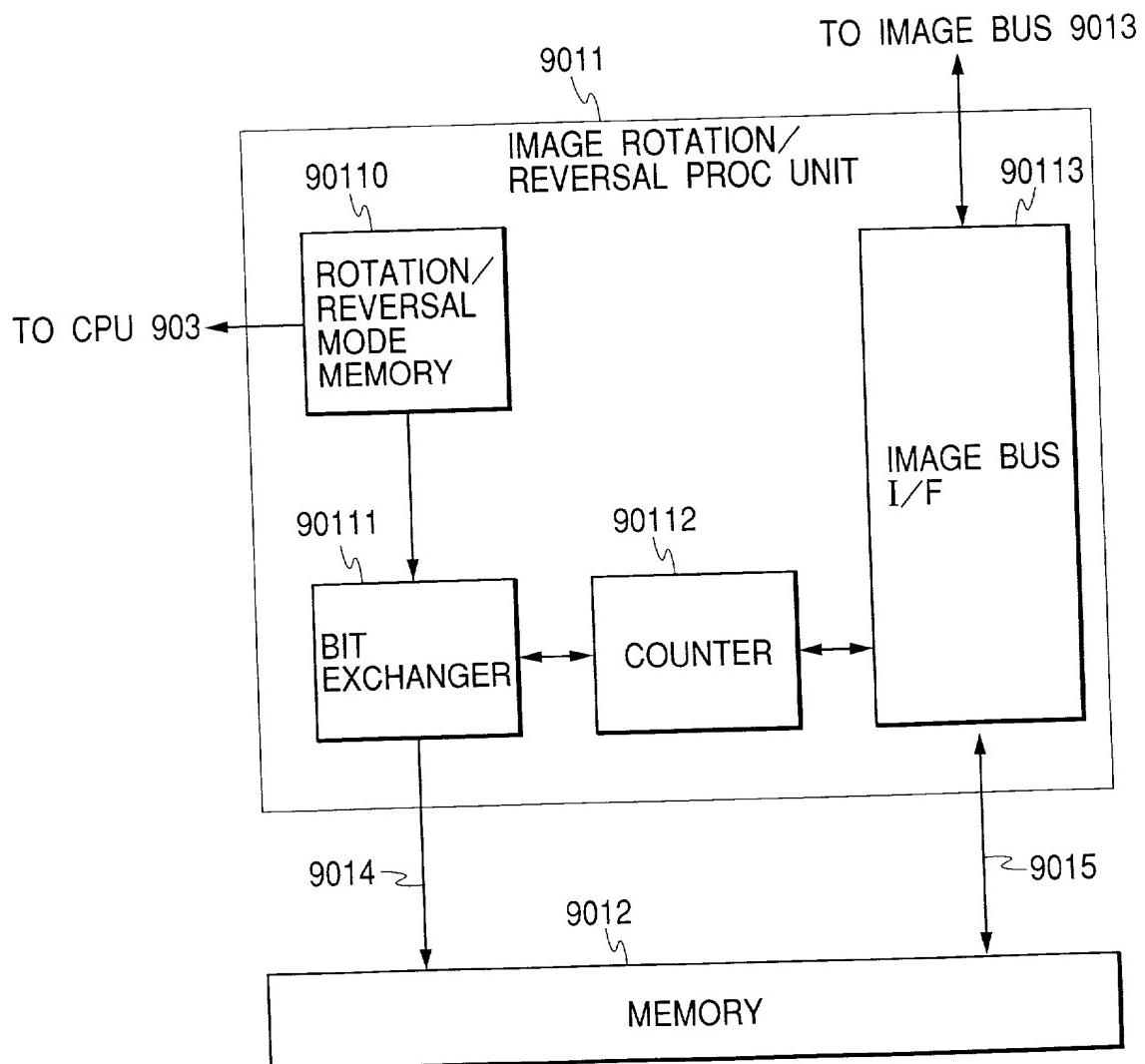
FIG. 6

FIG. 7

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

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FIG. 8

15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254
13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253
12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252
11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251
10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250
9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249
8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248
7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247
6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246
5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245
4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244
3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243
2	18	34	50	66	82	98	114	130	146	162	198	194	210	226	242
1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241
0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240

FIG. 9

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255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240
239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

FIG. 10

240	224	208	192	176	160	144	128	112	96	80	64	48	32	16	0
241	225	209	193	177	161	145	129	113	97	81	65	49	33	17	1
242	226	210	194	178	162	146	130	114	98	82	66	50	34	18	2
243	227	211	195	179	163	147	131	115	99	83	67	51	35	19	3
244	228	212	196	180	164	148	132	116	100	84	68	52	36	20	4
245	229	213	197	181	165	149	133	117	101	85	69	53	37	21	5
246	230	214	198	182	166	150	134	118	102	86	70	54	38	22	6
247	231	215	199	183	167	151	135	119	103	87	71	55	39	23	7
248	232	216	200	184	168	152	136	120	104	88	72	56	40	24	8
249	233	217	201	185	169	153	137	121	105	89	73	57	41	25	9
250	234	218	202	186	170	154	138	122	106	90	74	58	42	26	10
251	235	219	203	187	171	155	139	123	107	91	75	59	43	27	11
252	236	220	204	188	172	156	140	124	108	92	76	60	44	28	12
253	237	221	205	189	173	157	141	125	109	93	77	61	45	29	13
254	238	222	206	190	174	158	142	126	110	94	78	62	46	30	14
255	239	223	207	191	175	159	143	127	111	95	79	63	47	31	15

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FIG. 11

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128
159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160
191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192
223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224
255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

FIG. 12

0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240
1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241
2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242
3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243
4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244
5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245
6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246
7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247
8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248
9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249
10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250
11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251
12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252
13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253
14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254
15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255

FIG. 13

240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

FIG. 14

255	239	223	207	191	175	159	143	127	111	95	79	63	47	31	15
254	238	222	206	190	174	158	142	126	110	94	78	62	46	30	14
253	237	221	205	189	173	157	141	125	109	93	77	61	45	29	13
252	236	220	204	188	172	156	140	124	108	92	76	60	44	28	12
251	235	219	203	187	171	155	139	123	107	91	75	59	43	27	11
250	234	218	202	186	170	154	138	122	106	90	74	58	42	26	10
249	233	217	201	185	169	153	137	121	105	89	73	57	41	25	9
248	232	216	200	184	168	152	136	120	104	88	72	56	40	24	8
247	231	215	199	183	167	151	135	119	103	87	71	55	39	23	7
246	230	214	198	182	166	150	134	118	102	86	70	54	38	22	6
245	229	213	197	181	165	149	133	117	101	85	69	53	37	21	5
244	228	212	196	180	164	148	132	116	100	84	68	52	36	20	4
243	227	211	195	179	163	147	131	115	99	83	67	51	35	19	3
242	226	210	194	198	162	146	130	114	98	82	66	50	34	18	2
241	225	209	193	177	161	145	129	113	97	81	65	49	33	17	1
240	224	208	192	176	160	144	128	112	96	80	64	48	32	16	0

FIG. 15

IMAGE PROC CONTENTS	BIT EXCHANGE CONTENTS A(i) : iTH BIT IN ADDRESS OUTPUT C(i) : iTH BIT IN COUNTER INPUT
COUNTERCLOCKWISE 90° IMAGE ROTATION	$A(7) \leftarrow C(3);$ $A(6) \leftarrow C(2);$ $A(5) \leftarrow C(1);$ $A(4) \leftarrow C(0);$ $A(3) \leftarrow \text{not } C(7);$ $A(2) \leftarrow \text{not } C(6);$ $A(1) \leftarrow \text{not } C(5);$ $A(0) \leftarrow \text{not } C(4);$
COUNTERCLOCKWISE 180° IMAGE ROTATION	$A(7) \leftarrow \text{not } C(7);$ $A(6) \leftarrow \text{not } C(6);$ $A(5) \leftarrow \text{not } C(5);$ $A(4) \leftarrow \text{not } C(4);$ $A(3) \leftarrow \text{not } C(3);$ $A(2) \leftarrow \text{not } C(2);$ $A(1) \leftarrow \text{not } C(1);$ $A(0) \leftarrow \text{not } C(0);$
COUNTERCLOCKWISE 270° IMAGE ROTATION	$A(7) \leftarrow \text{not } C(3);$ $A(6) \leftarrow \text{not } C(2);$ $A(5) \leftarrow \text{not } C(1);$ $A(4) \leftarrow \text{not } C(0);$ $A(3) \leftarrow C(7);$ $A(2) \leftarrow C(6);$ $A(1) \leftarrow C(5);$ $A(0) \leftarrow C(4);$
IMAGE REVERSAL	$A(7) \leftarrow C(7);$ $A(6) \leftarrow C(6);$ $A(5) \leftarrow C(5);$ $A(4) \leftarrow C(4);$ $A(3) \leftarrow \text{not } C(3);$ $A(2) \leftarrow \text{not } C(2);$ $A(1) \leftarrow \text{not } C(1);$ $A(0) \leftarrow \text{not } C(0);$
COUNTERCLOCKWISE 90° IMAGE ROTATION AFTER IMAGE REVERSAL	$A(7) \leftarrow C(3);$ $A(6) \leftarrow C(2);$ $A(5) \leftarrow C(1);$ $A(4) \leftarrow C(0);$ $A(3) \leftarrow C(7);$ $A(2) \leftarrow C(6);$ $A(1) \leftarrow C(5);$ $A(0) \leftarrow C(4);$
COUNTERCLOCKWISE 180° IMAGE ROTATION AFTER IMAGE REVERSAL	$A(7) \leftarrow \text{not } C(7);$ $A(6) \leftarrow \text{not } C(6);$ $A(5) \leftarrow \text{not } C(5);$ $A(4) \leftarrow \text{not } C(4);$ $A(3) \leftarrow C(3);$ $A(2) \leftarrow C(2);$ $A(1) \leftarrow C(1);$ $A(0) \leftarrow C(0);$
COUNTERCLOCKWISE 270° IMAGE ROTATION AFTER IMAGE REVERSAL	$A(7) \leftarrow \text{not } C(3);$ $A(6) \leftarrow \text{not } C(2);$ $A(5) \leftarrow \text{not } C(1);$ $A(4) \leftarrow \text{not } C(0);$ $A(3) \leftarrow \text{not } C(7);$ $A(2) \leftarrow \text{not } C(6);$ $A(1) \leftarrow \text{not } C(5);$ $A(0) \leftarrow \text{not } C(4);$
THROUGH	$A(7) \leftarrow C(7);$ $A(6) \leftarrow C(6);$ $A(5) \leftarrow C(5);$ $A(4) \leftarrow C(4);$ $A(3) \leftarrow C(3);$ $A(2) \leftarrow C(2);$ $A(1) \leftarrow C(1);$ $A(0) \leftarrow C(0);$

FIG. 16

COUNTER OUTPUT VALUE C(7:0) UPPER STAGE: DECIMAL NUMBER NOTATION LOWER STAGE: BINARY NUMBER NOTATION	VALUE AFTER BIT EXCHANGE A(7:0) UPPER STAGE: DECIMAL NUMBER NOTATION LOWER STAGE: BINARY NUMBER NOTATION
0 00000000	15 00001111
1 00000001	31 00011111
2 00000010	47 00101111
3 00000011	63 00111111
4 00000100	79 01001111
5 00000101	95 01011111
6 00000110	111 01101111
7 00000111	127 01111111
8 00001000	143 10001111
9 00001001	159 10011111
10 00001010	175 10101111
<hr/>	
251 11111011	176 10110000
252 11111100	192 11000000
253 11111101	208 11010000
254 11111110	224 11100000
255 11111111	240 11110000

FIG. 17

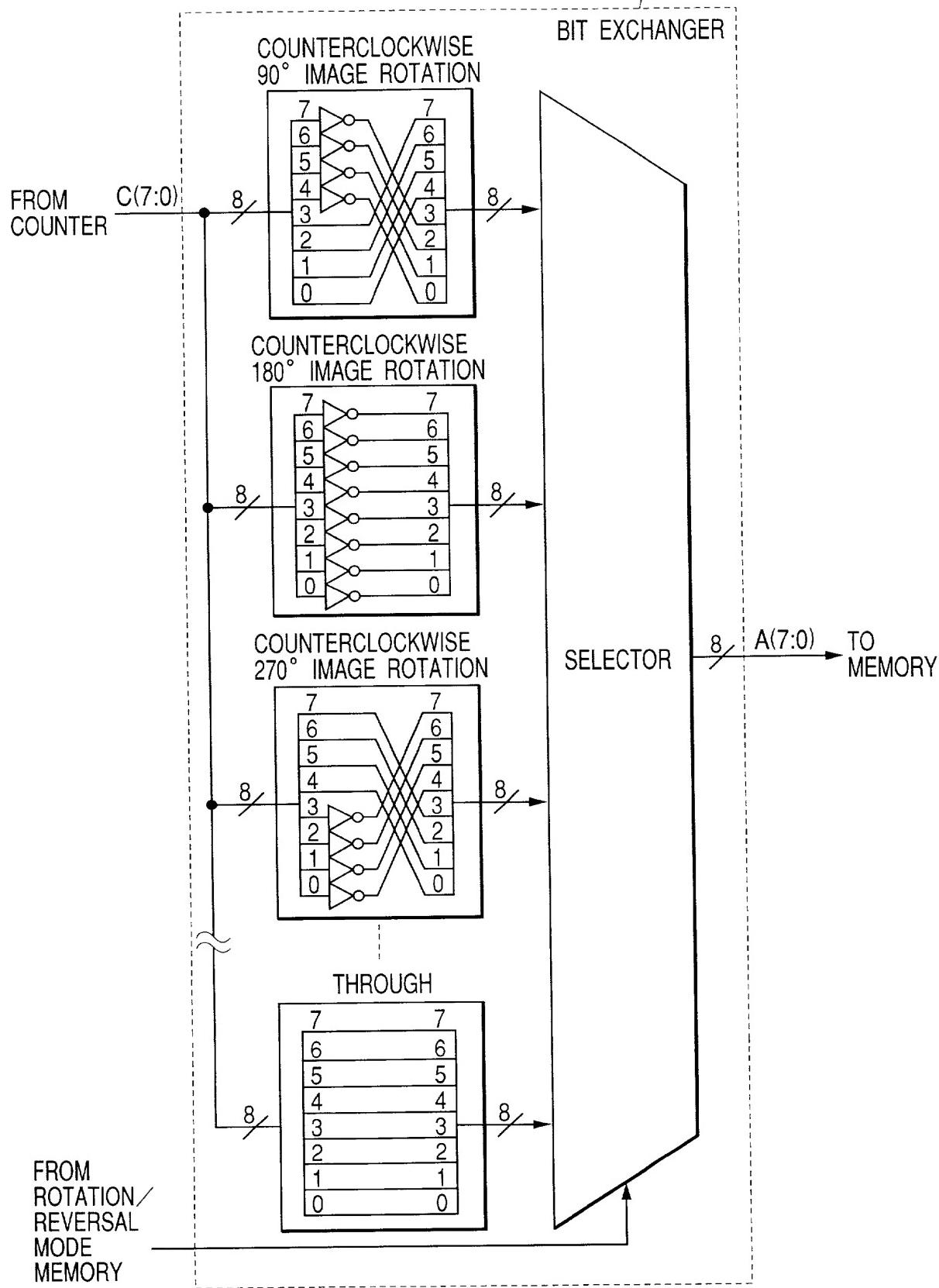
90111
~

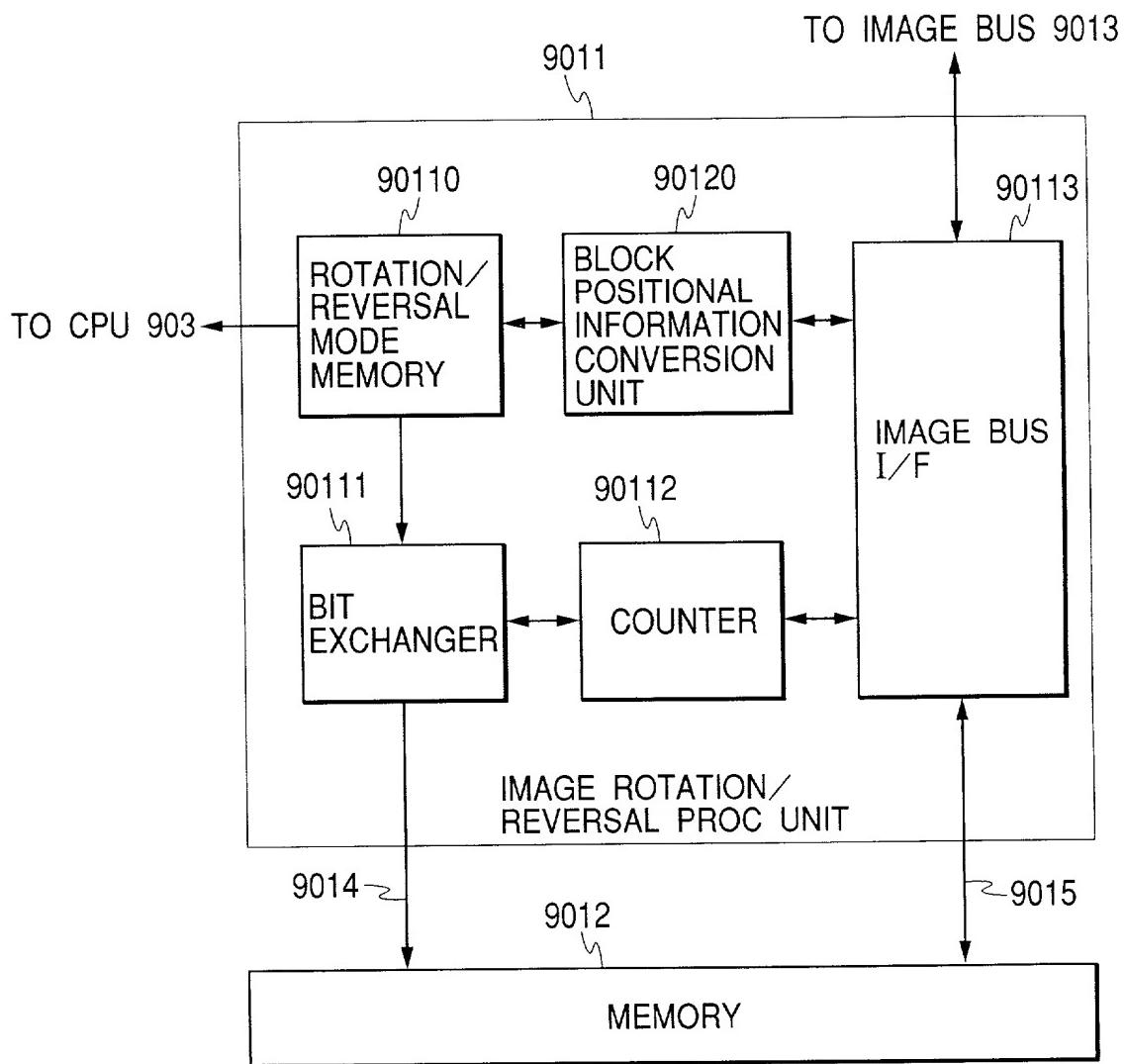
FIG. 18

FIG. 19

(0,0)	(1,0)	(2,0)	(3,0)	(4,0)	(5,0)	(6,0)	(7,0)	(8,0)	(9,0)
(0,1)	(1,1)	(2,1)	(3,1)	(4,1)	(5,1)	(6,1)	(7,1)	(8,1)	(9,1)
(0,2)	(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)	(7,2)	(8,2)	(9,2)
(0,3)	(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)	(7,3)	(8,3)	(9,3)
(0,4)	(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)	(8,4)	(9,4)
(0,5)	(1,5)	(2,5)	(3,5)	(4,5)	(5,5)	(6,5)	(7,5)	(8,5)	(9,5)
(0,6)	(1,6)	(2,6)	(3,6)	(4,6)	(5,6)	(6,6)	(7,6)	(8,6)	(9,6)
(0,7)	(1,7)	(2,7)	(3,7)	(4,7)	(5,7)	(6,7)	(7,7)	(8,7)	(9,7)

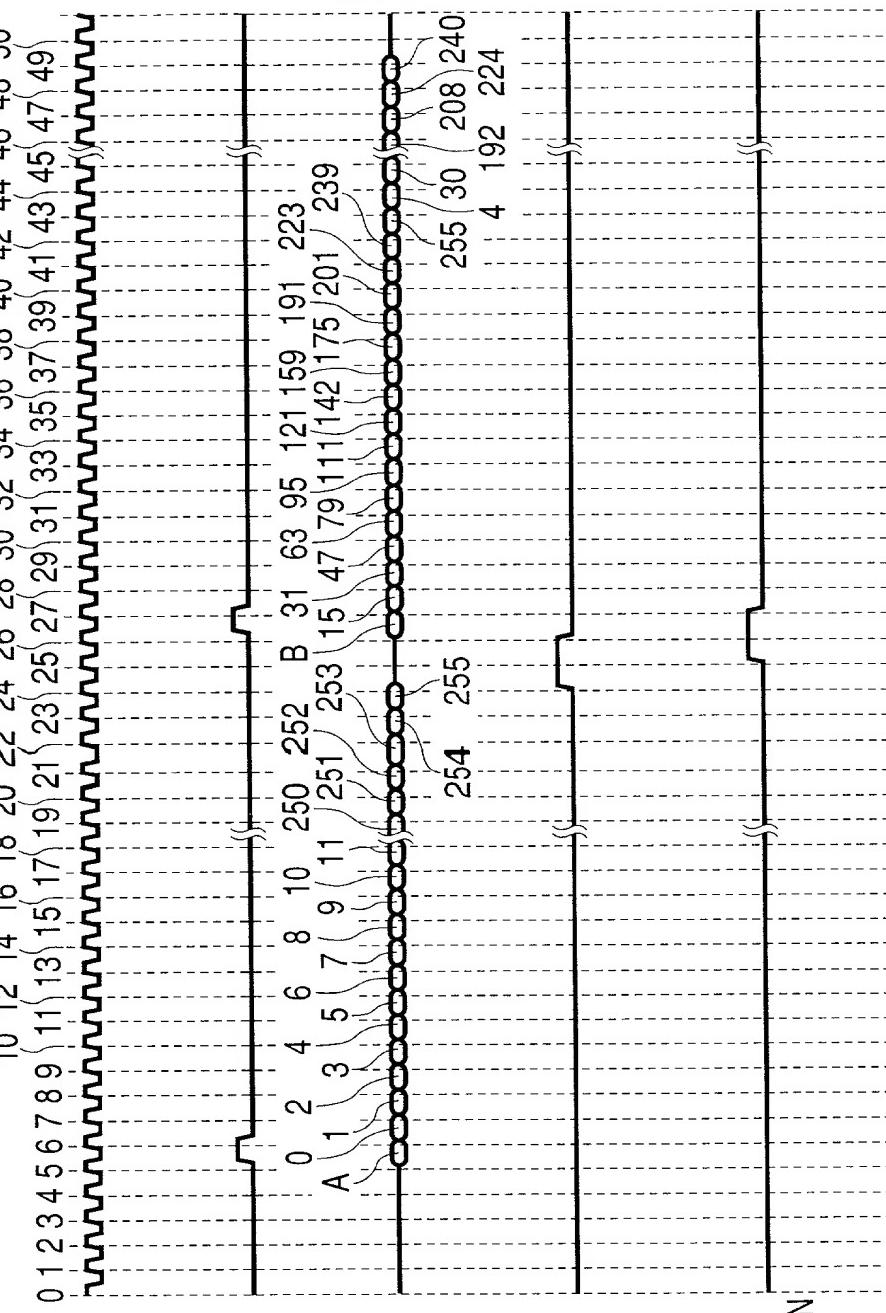


FIG. 21

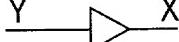
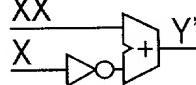
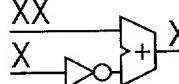
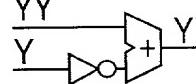
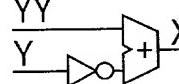
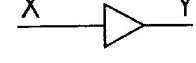
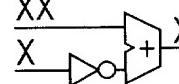
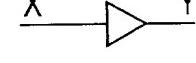
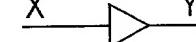
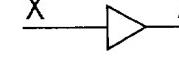
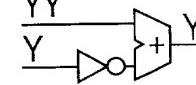
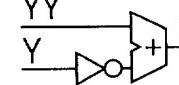
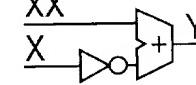
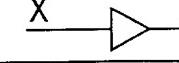
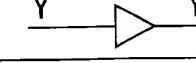
IMAGE PROC CONTENTS	TRANSFORMATION X',Y': POSITIONAL INFORMATION OUTPUT X,Y: POSITIONAL INFORMATION INPUT XX: THE NUMBER OF BLOCKS IN HORIZONTAL DIRECTION YY: THE NUMBER OF BLOCKS IN VERTICAL DIRECTION	X' STRUCTURE CKT	Y' STRUCTURE CKT
COUNTERCLOCKWISE 90° IMAGE ROTATION	$X' \leftarrow Y$ $Y' \leftarrow XX-1-X$	 X'	 Y'
COUNTERCLOCKWISE 180° IMAGE ROTATION	$X' \leftarrow XX-1-X$ $Y' \leftarrow YY-1-Y$	 X'	 Y'
COUNTERCLOCKWISE 270° IMAGE ROTATION	$X' \leftarrow YY-1-Y$ $Y' \leftarrow X$	 X'	 Y'
IMAGE REVERSAL	$X' \leftarrow XX-1-X$ $Y' \leftarrow Y$	 X'	 Y'
COUNTERCLOCKWISE 90° IMAGE ROTATION AFTER IMAGE REVERSAL	$X' \leftarrow Y$ $Y' \leftarrow X$	 X'	 Y'
COUNTERCLOCKWISE 180° IMAGE ROTATION AFTER IMAGE REVERSAL	$X' \leftarrow X$ $Y' \leftarrow YY-1-Y$	 X'	 Y'
COUNTERCLOCKWISE 270° IMAGE ROTATION AFTER IMAGE REVERSAL	$X' \leftarrow YY-1-Y$ $Y' \leftarrow XX-1-X$	 X'	 Y'
THROUGH	$X' \leftarrow X$ $Y' \leftarrow Y$	 X'	 Y'

FIG. 22

(0,9)	(0,8)	(0,7)	(0,6)	(0,5)	(0,4)	(0,3)	(0,2)	(0,1)	(0,0)
(1,9)	(1,8)	(1,7)	(1,6)	(1,5)	(1,4)	(1,3)	(1,2)	(1,1)	(1,0)
(2,9)	(2,8)	(2,7)	(2,6)	(2,5)	(2,4)	(2,3)	(2,2)	(2,1)	(2,0)
(3,9)	(3,8)	(3,7)	(3,6)	(3,5)	(3,4)	(3,3)	(3,2)	(3,1)	(3,0)
(4,9)	(4,8)	(4,7)	(4,6)	(4,5)	(4,4)	(4,3)	(4,2)	(4,1)	(4,0)
(5,9)	(5,8)	(5,7)	(5,6)	(5,5)	(5,4)	(5,3)	(5,2)	(5,1)	(5,0)
(6,9)	(6,8)	(6,7)	(6,6)	(6,5)	(6,4)	(6,3)	(6,2)	(6,1)	(6,0)
(7,9)	(7,8)	(7,7)	(7,6)	(7,5)	(7,4)	(7,3)	(7,2)	(7,1)	(7,0)